Turning down the heat: the impact of cool roof intervention on intimate partner violence

Abstract

Climate change presents a growing threat, particularly to developing countries, where rising temperatures are expected to worsen a variety of social and health issues. This study evaluates the impact of a simple, cost-effective passive cool roof intervention, aimed at reducing indoor temperatures, on the incidence of intimate partner violence (IPV), a significant developmental and policy concern. Using a clustered randomized control trial (cRCT) and double list experiment design, we assess how this temperature-reducing intervention influences the occurrence of IPV incidents. Our findings show that the cool roof intervention leads to a 7-10 percentage point reduction in IPV. This reduction is quite substantial given the established added impact of the intervention on economic as well as women's mental health. The research provides strong evidence of the efficacy of cool roof interventions in mitigating IPV in the context of developing countries. It also highlights the importance of addressing climate change not only for environmental reasons but also for its broader societal implications.

Keywords: *intimate partner violence, cool roof, temperature, women, list experiment, Burkina Faso*

1. Introduction: background and motivation

Intimate Partner Violence (IPV) remains a global public health concern, affecting individuals across diverse sociocultural backgrounds and economic strata (WHO 2018). Defined as any behavior within an intimate relationship that causes physical, psychological, or sexual harm to one's partner, IPV poses profound and enduring consequences for victims and their communities. Although both males and females can be affected by IPV, the majority of the victims are females. A multi-country[1] study of women aged 15-49 (Garcia-Moreno et al. 2006) found that up to 71% of participants had experienced physical and/or sexual violence. IPV is associated with a range of long-term adverse health outcomes, including physical impairments such as mobility difficulties, chronic pain, and memory loss, as well as mental health disorders, including suicidal ideation and emotional distress (Ellsberg et al. 2008).

High ambient temperature has been identified as a major or underlying cause of IPV (Anderson et al. 2000; Hsiang, Burke, and Miguel 2013a; Nguyen 2024). Increasing evidence suggests that exposure to high temperature contributes to heightened levels of stress, frustration, and aggression. Studies have documented a positive correlation between rising temperature and heightened irritability and discomfort, which may intensify interpersonal tensions (Anderson, Deuser, and DeNeve 1995). Additionally, prolonged exposure to heat can disrupt sleep patterns and impair cognitive functioning, diminishing individuals' ability to cope with interpersonal conflicts effectively (Lan et al. 2017). Social factors further amplify this risk, as higher temperatures are linked to increased alcohol consumption and social gatherings, both of which have been identified as risk factors for IPV (Sanz-Barbero et al. 2018). Moreover, extreme heat events negatively impact agricultural yields, particularly in regions reliant on subsistence farming, leading to income loss and heightened financial stress—both of which are strongly associated with IPV escalation (Allen et al., 2021).

Given the ongoing rise in global temperatures, adaptation strategies that reduce indoor heat exposure are critical for mitigating heat-induced IPV risk. One promising intervention is the implementation of cool roofs, which minimize solar heat absorption and enhance thermal emission. Cool roofs provide a cost-effective, passive cooling solution, particularly for low-income communities in climate-vulnerable regions (Kolokotroni et al., 2018; Pisello et al., 2013). By maintaining indoor thermal comfort, this intervention may help reduce heat-induced stress, improve sleep quality, and enhance emotional regulation, thereby potentially lowering IPV incidence.

[1] *The countries covered in the study were: Bangladesh, Brazil, Ethiopia, Japan, Namibia, Peru, Samoa, Serbia and Montenegro, Thailand, and the United Republic of Tanzania.*

Despite extensive research on the economic (e.g., cost savings) and environmental (e.g., reduced energy demand) benefits of cool roofs (Broadbent et al., 2022; Khorat et al., 2024; Levinson & Akbari, 2010; Rawat & Singh, 2022), their social impacts—particularly their influence on interpersonal relationships—remain understudied. Furthermore, most existing studies focus on high-income, urban settings, limiting insights into the effectiveness of cool roofs in low-income or rural contexts.

This study investigates the effectiveness of cool roofs in mitigating IPV through a clustered randomized controlled trial (cRCT) conducted in Nouna, a rural region in Burkina Faso. A total of 600 households were randomly assigned to either the intervention group (300 households receiving cool roofs) or the control group, enabling causal inference on the impact of passive cooling on IPV. Given the sensitivity of IPV reporting, a double-list randomization experiment was employed to collect data from female participants, minimizing social desirability bias (Gibson et al. 2022; Peterman et al. 2018). The study further examines the underlying mechanisms linking temperature reduction to IPV, focusing on microeconomic and psychosocial factors, including sleep quality and thermal comfort.

Our analysis reveals four key results. First, cool roof intervention is effective in reducing indoor temperature. The daytime temperature of houses that received the cool roof intervention is lower by 1.8 degrees centigrade (<0.001). Second, IPV is significantly prevalent in the study setting. About 7% of women reported to have faced IPV[2]. Third, our study demonstrates that the cool roof intervention leads to a 7-10 percentage point reduction in IPV incident. Fourth, the effects are not significantly higher in the hot season, perhaps indicating the lagged effect of the intervention. The overall result suggests that interventions that reduce indoor temperature can have a tangible impact on reducing the occurrence and severity of IPV. This finding holds promising implications for public health initiatives seeking novel approaches to IPV prevention and intervention.

This study also underscores the significant health benefits of tackling climate change. Rising temperature, a key component of climate change, is already a major driver of both intergroup and interpersonal conflicts (Hsiang et al., 2013a; Mach et al., 2019), and this impact is likely to intensify as global temperatures continue to rise (Mach et al. 2019). Our findings suggest that implementing a simple, cost-effective adaptation mechanism in climate hotspot regions in low-income countries holds a huge potential to improve public health outcomes. By mitigating the adverse effects of extreme heat, such interventions could not only reduce the incidence of heat-related illnesses but also play a crucial role in curbing domestic violence, which is exacerbated by high temperatures.

The rest of the paper is organized as follows. The next section briefly presents the design of the overall study and the description of the data. Section 3 highlights the econometric

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[2] Since a baseline data is not available, this refers to the prevalence rate among the control groups. The treated groups are excluded to reduce the contamination resulting from the intervention.

model used in estimation. Section 4 discusses the result before concluding remarks are given in the last section.

2. Design of the study and description of data

2.1. Research design of the overall study

The data used in this study is collected as part of a broader project led by the Heidelberg Institute of Global Health (HIGH) in collaboration with Nouna Health Research Centre (CRSN). The project is aimed at studying the impact of sunlight-reflecting roof coatings, known as 'cool roofs,' on the health, environmental, and economic outcomes in Nouna, rural Burkina Faso (Bunker et al. 2024). This is a two-year community-based stratified cluster randomized controlled trial (cRCT) involving 600 households and 1,200 participants (600 males and 600 females).

The stratification is based on the village of residence and the two types of roofing materials that exist in the study community (mud brick and tin). In each of the 25 randomly selected villages, 12 houses with each of the two roof types were randomly selected for the study. Overall, 600 houses were randomly assigned to either the intervention group or the control group. The intervention group (300 houses) received cool roof installations, while the control group did not undergo any changes to their roofing system (see *Figure 1* for details on the design).

Participants were recruited from households that met specific criteria, such as residing in the Nouna Health and Demographic Surveillance System (HDSS), and have consented to participate in the study. However, ethnicity, race, political orientation, religion, and class are not criteria for inclusion or exclusion in the study (Bunker et al. 2024b). The main data collection was based on monthly home visits and conducted between August 2021 and June 2023[3].

[3] *Data collection on other variables such as indoor climate variables (temperature, precipitation) and key health indicators (e.g. heartbeat, sleep quality and activities) was collected every 15-30 min using devises installed indoors or worn by the respondents. Behavioral variables such as IPV, trust, affect were collected seasonally.*

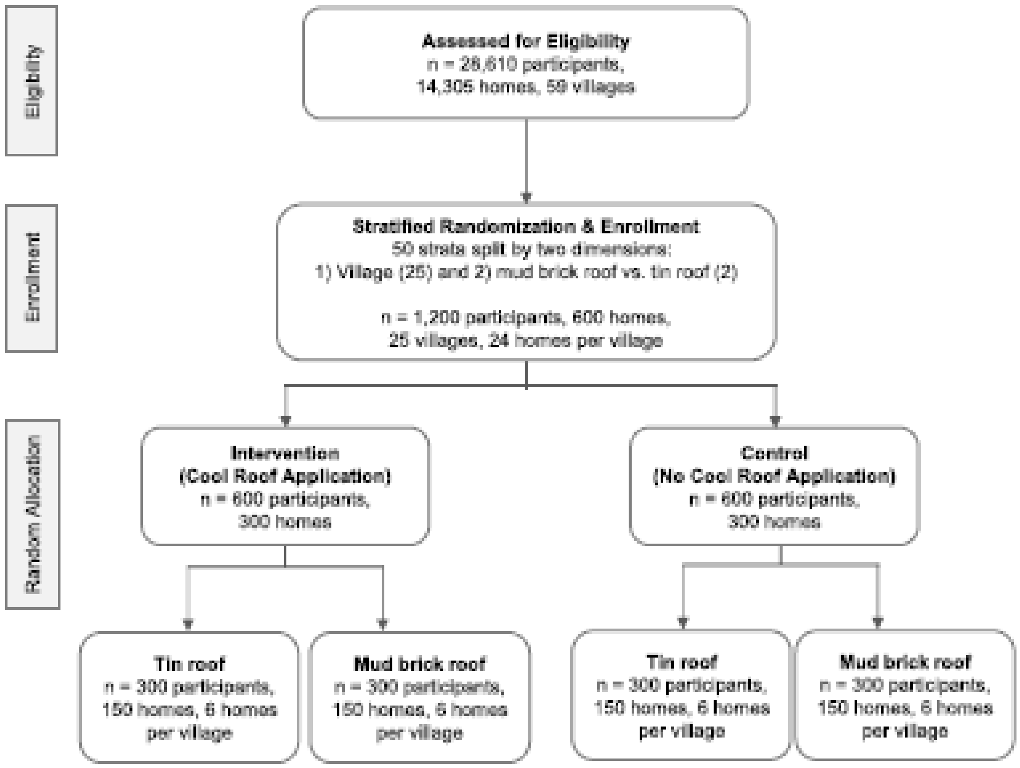

Figure 1: Sample design of the cool roof trial.

Table 1 presents the socio-demographic characteristics of sample respondents used in the analysis by treatment status and overall. The average household is headed by a 42-year-old male and includes about 7 family members, of which 4 members live in the household at the time of the survey. The average residence house is about 33 square meters in area with little to no access to electricity. None of the households use cooling and heating appliances. About 60 percent of the respondents had privacy when responding to the survey questions. The random assignment of households generated comparable treatment and control groups at a household level, with differences in all selected variables being statistically insignificant except for access to electricity. We will include access to electricity in all the regressions.

Table 1: Balance test by treatment status.

Variable	(1) Total	(2) Control	(3) Treated	(2)-(3) Mean diff. test
age	42.98	43.25	42.71	0.536
	(0.37)	(0.54)	(0.52)	
Female	0.50	0.51	0.50	0.013
	(0.02)	(0.02)	(0.02)	
Household size	6.86	6.93	6.78	0.157
	(0.12)	(0.17)	(0.16)	
# of residents	3.98	4.00	3.96	0.042

	(0.05)	(0.07)	(0.07)	
Area of residence (sqm.)	33.06	33.69	32.44	1.252
	(4.79)	(8.02)	(5.24)	
Access to electricity	0.04	0.02	0.05	-0.025**
	(0.01)	(0.01)	(0.01)	
Owns cooling/heating appliances	0.01	0.01	0.01	-0.002
	(0.00)	(0.00)	(0.00)	
Observations	1,190	596	594	1,190

*Note: The value displayed in parenthesis is the standard deviation. The values displayed for t-tests are the differences in the means across the groups. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.*

The hypothesized impact of cool roof intervention on IPV is predicated on the expected lower indoor temperature in houses where the cool roof coating was applied. Therefore, it is important to first test this link between heat exposure and the intervention. Since the temperature-reducing impact of the cool intervention is particularly more pertinent during the warm season, we compare heat exposure and thermal comfort in the control and treated households separately for cold and warm seasons (*Table 2*).

Panel A presents self-reported thermal comfort in both control and treated households. The first two columns reveal no statistically significant difference in thermal comfort between the two groups during the cold season. However, during the warm season (e.g., April), control households report significantly more discomfort than treated households. This pattern holds whether individual measures (e.g., excessive sweating) or the aggregate index (HSSI)[4] are used.

[4] *HSSI is a weighted average score of several indicators of heat stress at home, such as state of indoor temperature (humidity, airflow), adopted heat regulation mechanisms (clothing, ventilation), and heat-related sickness symptoms (headache, dizziness, muscle pain).*

Table 2: Comparison of thermal comfort by treatment status by season (Mean/(SE))

Variable	Cold Season Control	Cold Season Mean difference	Warm Season Control	Warm Season Mean difference
Panel A: Self-reported thermal comfort level				
Excessive sweating, yes=1	0.00	-0.004	0.19	-0.147***
	(0.00)		(0.02)	
Thirsty, yes=1	0.61	0.010	0.95	-0.129***
	(0.02)		(0.01)	
Muscle/Heat cramps, yes=1	0.00	0.002	0.15	-0.106***
	(0.00)		(0.02)	
Tiredness/weakness, yes=1	0.02	-0.002	0.23	-0.103***
	(0.01)		(0.02)	
Dizziness, yes=1	0.00	0.007	0.02	-0.004
	(0.00)		(0.01)	
Headaches, yes=1	0.05	0.008	0.12	-0.008
	(0.01)		(0.01)	
Nausea or vomiting, yes=1	0.00	0.002	0.01	-0.005
	(0.00)		(0.00)	
Heat stress is bad, yes=1	0.18	0.001	0.33	-0.074***
	(0.02)		(0.02)	
Heat strain score index (HSSI)	**1.91**	**0.084**	**9.88**	**-1.914*****
	(0.11)		(0.10)	
Panel B: Climate data collected using sensors				
Daily min. temperature	26.35	-0.993***	32.60	-0.764***
	(0.10)		(0.08)	
Daily mean temperature	30.40	-1.200***	36.01	-1.208***
	(0.07)		(0.07)	
Daily max. temperature	34.97	-1.455***	40.18	-1.879***
	(0.12)		(0.12)	
Observations	571	1147	559	1,124

***Note**: The value displayed in parenthesis is the standard deviation. The values displayed for t-tests are the differences in the means across the groups. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level*

Panel B shows data collected by climate sensors installed in the houses, indicating a significant difference in temperature levels between control and treated households throughout the year. These differences are particularly pronounced during the warm season, especially when looking at daily maximum temperatures.

To formalize this analysis, we run a regression of daily temperature (z-score) and HSSI on the household treatment indicator, controlling for seasonal fixed effects and household characteristics. *Figure 2* demonstrates the intervention's effectiveness in improving thermal comfort. It illustrates that while the cool roof intervention generally reduces thermal stress, its impact is notably stronger during warm months (April, July, and October) compared to the reference month, January. The actual temperature data aligns with and supports these overall findings.

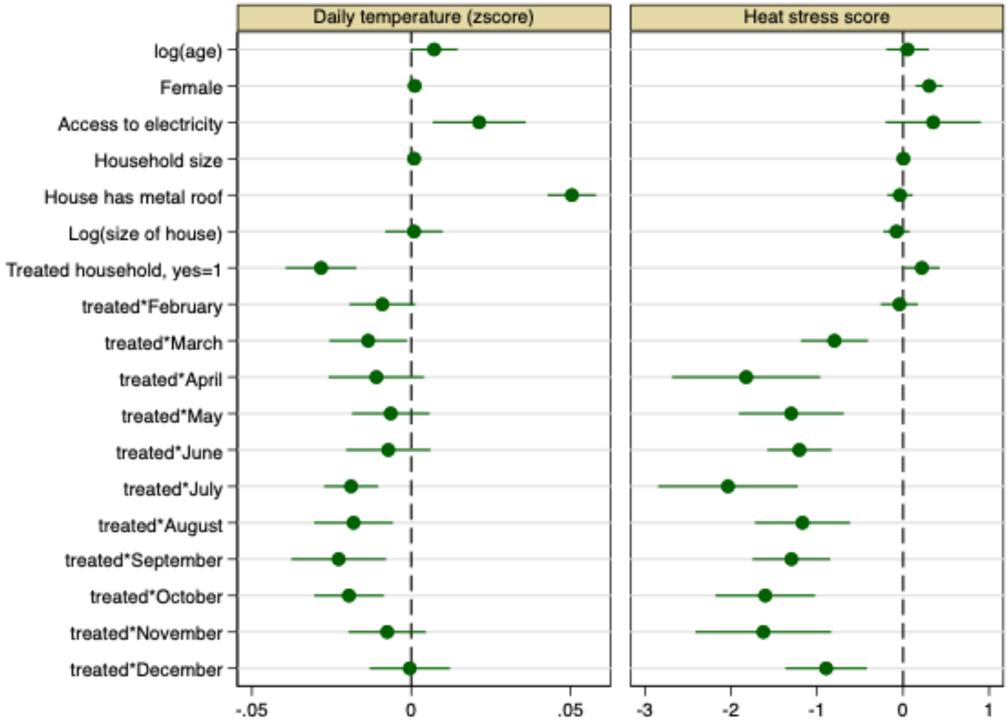

Figure 2: Correlates of Heat Strain Score Index (HSSI)

Note: Dots: coefficient from ordinary least square regressions; Bars: 95% confidence intervals; Excluded category: village-level fixed effect. This regression result is obtained by estimating equation: $Y_i = \alpha + \beta_1 T_i + \beta_2 H_i + \beta_3 X_i * T_i + \beta_4 X_i + \varepsilon_i$, *where* Y_i *is HSSI/daily temperature;* H_i *is monthly dummy;* X_i *is HH and location characteristics;* T_i *treatment dummy.*

2.2. Research design of the IPV sub-study

The survey part used for the IPV sub-study is based on 600 female respondents, 300 of whom were from houses that received the intervention, whereas the remaining 300 were from the control group. Baseline data on IPV prevalence and household characteristics were not collected before the intervention due to a delay in ethical approval. Instead, IPV data was gathered seasonally over the course of the year. Our empirical approach leverages the distinct seasonal patterns in the study area (see Figure A1 in the appendix) (see section 3 for methods).

Direct elicitation of intimate partner violence has proven difficult due to social desirability bias (Gibson et al. 2022b). This is especially the case for people who are poorly educated or live in households with less gender equality. A viable method to remedy this bias is by using alternative indirect questioning, such as list randomization (Peterman et al. 2018b). List randomization is a method to collect sensitive information in surveys discreetly. Respondents choose items from a randomized list, making it hard to discern their specific choices. This technique promotes more honest responses on sensitive topics, benefiting social science research and survey design (Gibson et al. 2022b).

In this study, half of the sample of women received a panel with 4 non-sensitive statements and were asked how many of the statements they agreed with. The other half received the same panel with one additional sensitive IPV item: "*Have you been slapped, punched, kicked, or physically harmed by your partner*" (see Table A1 in the appendix). By subtracting the number of affirmatively reported statements between the two groups, the percentage of women who report physical IPV can be estimated. The approach has been validated in different settings, including in sub-Saharan African countries (SSA), and proved to provide a more accurate estimate. For example, when a list randomization approach was used in Rwanda, the reports of IPV increased by 100% (Cullen 2020).

To increase efficiency, double-list experiments can be used for IPV-related surveys (Lépine, Treibich, and D'Exelle 2020). In this method, there are two lists (List A and List B) with different non-sensitive items, and two groups are utilized, with each group alternately serving as both the control group and the treatment group (Droitcour et al. 1991). The validity of the approach requires that there is no selection bias in allocating respondents to the list with the sensitive item or not. That is, on average, respondents who are allocated to the list with the sensitive item are the same as respondents who are allocated to the list without the sensitive item. We assess this balance by examining the distribution of individuals allocated to the two groups based on observable pre-treatment characteristics (Table 2). It shows that the characteristics of the two groups of respondents are statistically indistinguishable except for roof type, which is slightly higher for individuals in group 1.

Table 4 tabulates the average number of statements the respondents agreed with when presented with a panel with a list of 4 non-sensitive items (IPV0) and a panel with a list of 4 non-sensitive and one sensitive item (IPV1). As described in section 2.2, the difference between IPV1 and IPV0 represents the prevalence of physical IPV. The overall prevalence rate of IPV during the survey period was 7%[5]. Over the survey months, we observe only a modest difference in the number of agreed statements for the control group.

[5] *Since baseline data was not collected, these numbers are generated from individuals in the non-treatment group.*

Table 3: Balance test by group assignment

Variable	(1) Total	(2) Group 1	(3) Group 2	(2)-(3) Mean diff. test
age	40.17	40.32	40.01	0.31
	(0.37)	(0.53)	(0.51)	
Household size	6.80	6.84	6.76	0.08
	(0.11)	(0.16)	(0.15)	
# of female members >60	0.09	0.09	0.09	(0.00)
	(0.01)	(0.01)	(0.01)	
# of male members >60	0.17	0.17	0.16	0.02
	(0.01)	(0.02)	(0.02)	
# of female members <18	0.98	0.97	0.99	(0.03)
	(0.03)	(0.05)	(0.04)	
# of male members <18	0.97	0.97	0.97	0.01
	(0.03)	(0.04)	(0.05)	
# of female members 18-60	0.98	0.96	1.00	(0.04)
	(0.01)	(0.02)	(0.02)	
# of male members 18-60	0.91	0.92	0.90	0.02
	(0.02)	(0.02)	(0.02)	
Treated household	0.50	0.52	0.49	0.03
	(0.02)	(0.02)	(0.02)	
House has metal roof	0.51	0.54	0.48	0.057*
	(0.02)	(0.02)	(0.02)	
Access to electricity	0.02	0.02	0.02	0.01
	(0.00)	(0.01)	(0.01)	
Respondent has privacy	0.58	0.60	0.57	0.04
	(0.02)	(0.02)	(0.02)	
Log (size of house)	3.16	3.15	3.17	(0.01)
	(0.01)	(0.02)	(0.02)	
	1154	574	580	1154

*Note: The values displayed in parenthesis are standard deviations. The values displayed for t-tests are the differences in the means across the groups. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.*

Table 4: Average number of agreed statements

Months	(1) Total	(2) IPV0	(3) IPV1	(3)-(2) Mean diff.
1	1.42	1.40	1.44	0.04
2	1.61	1.54	1.69	**0.15**
4	1.49	1.46	1.52	0.06
6	1.49	1.47	1.51	0.04
7	1.47	1.45	1.49	0.04
10	1.48	1.45	1.50	0.05
Total	1.49	1.46	1.53	**0.07**

Note: The differences indicated in bold are statistically significant.

3. Econometric approach

To estimate the prevalence of sensitive behavior, we use the following regression:

$$Y_i = \alpha + \beta_1 IPV_i + \varepsilon_i \qquad (1)$$

Where Y_i is the number of statements the respondent agreed with and IPV_i is a binary variable equal to one if the respondent is assigned to the group that includes the IPV item and zero otherwise. The average sensitive behavior prevalence rate is then given by β_1 and corresponds to the average difference between the number of statements that the control group and the treatment group agreed with.

To estimate the influence of cool roof on the prevalence of the IPV, we add an interaction between IPV_i and the treatment categories (Equation 2). In this specification, β_1 reports the sensitive behavior prevalence rate among the control households, while ($\beta_1 + \beta_3$) indicates the sensitive behaviour prevalence rate among the treated households. Therefore, β_3 reports the difference in the prevalence rate of the sensitive behavior between individuals in the coated and non-coated roofs.

$$Y_i = \alpha + \beta_1 IPV_i + \beta_2 T_i + \beta_3 IPV_i * T_i + \varepsilon_i \qquad (2)$$

Furthermore, we include a dummy variable that takes a value of one if the individual draws the questions from List A and zero if they draw is from List B. This controls for whether the prevalence rate of the IPV item differs between the two lists used in the survey. Finally, we include other relevant household characteristics, such as access to electricity, household size, type of roof, interview privacy, size of the house, and village fixed effects.

4. Results and discussions

4.1. Prevalence of intimate partner violence (IPV)

Figure 3 presents the estimation result from Equation 1. It shows that the average number of agreed statements is higher when the list contains the sensitive item – indicating the prevalence of IPV in the study setting. This is robust to the design effect (whether List A or List B is used), the group the individual is assigned to (Group 1 or Group 2), and the type of roofing (mud or metal). In line with the result in Table 4, the rate of prevalence of physical IPV in the study setting is 7% ($p<0.05$).

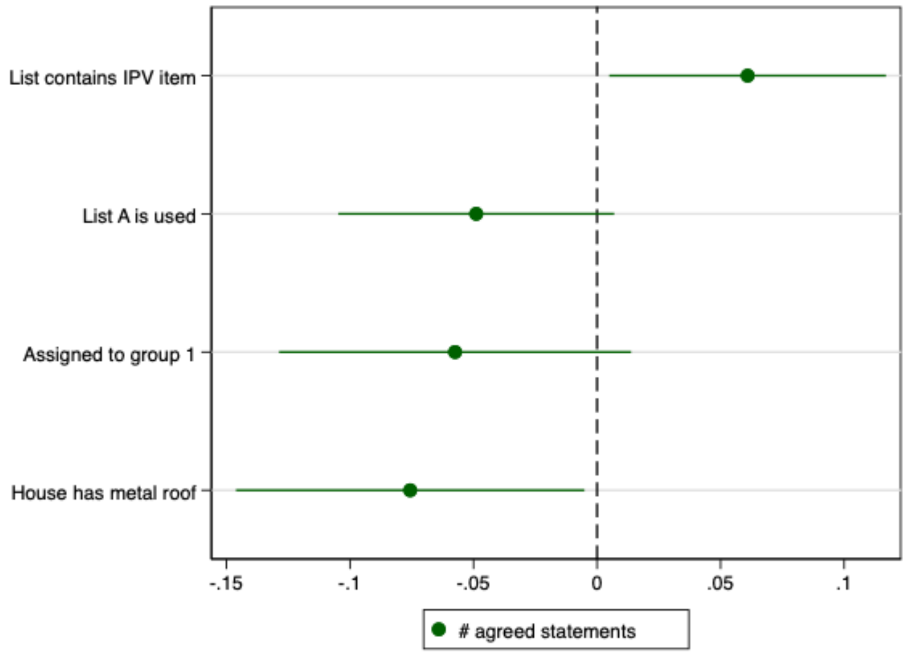

Figure 3: Regression result of prevalence of IPV

***Note**: Dots: coefficient from ordinary least square regressions; Bars: 95% confidence intervals. This regression result is obtained by estimating equation:* $Y_i = \alpha + \beta_1 IPV_i + \beta_2 X_i + \varepsilon_i$, *where* Y_i *is the number of statements participants is agreed with;* X_i *is HH and location characteristics;* IPV_i *is a binary variable that indicates whether the list contains an IPV item or not. Village-level fixed effects are included but not reported here for brevity.*

4.2. Impact of cool roof on the prevalence of IPV

Estimation of the impact of the cool roof on the prevalence of IPV is tantamount to estimating the coefficient of the interaction term (IPV*treated) in Equation 2. In *Figure 4*, the coefficient of the interaction term is negative and statistically significant, indicating that the intervention group, which received the cool roof installations, reported lower IPV incidents compared to the control group. Specifically, the cool roof intervention leads to a reduction in IPV incidents by 9 percentage points (left panel). This is robust to the inclusion of additional controls in the regression (right panel).

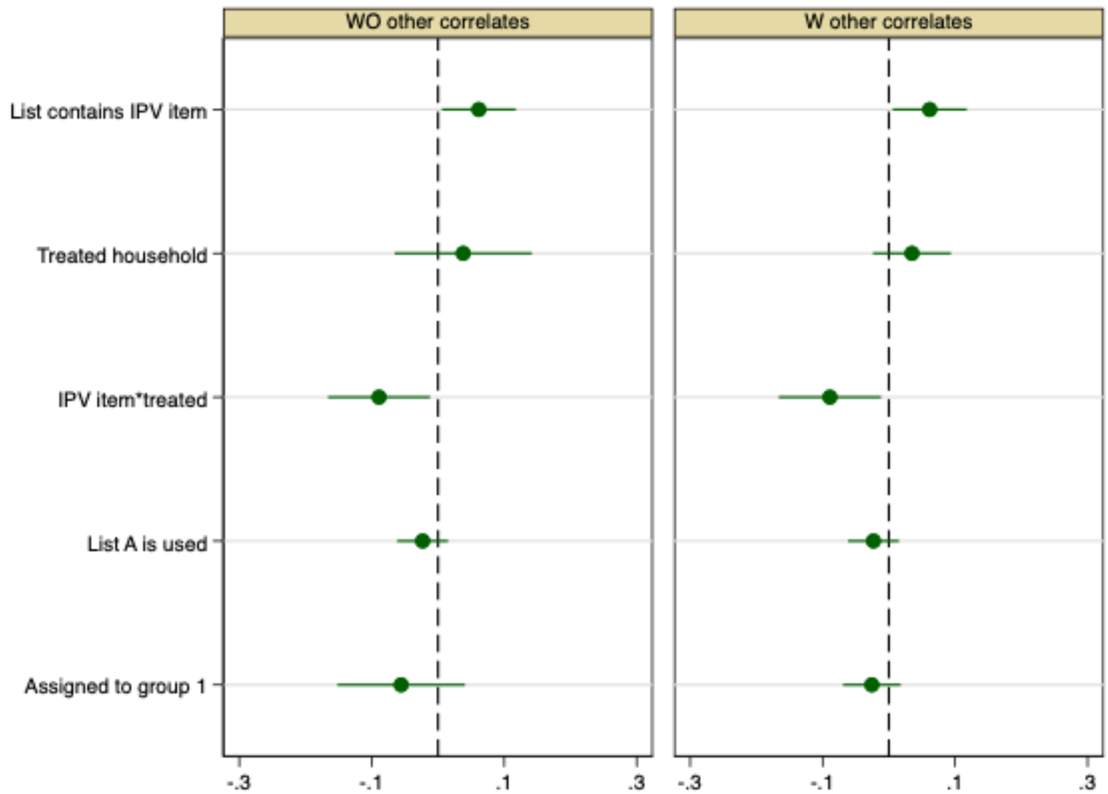

Figure 4: Regression result of IPV on treatment status

Note: *Dots: coefficient from ordinary least square regressions; Bars: 95% confidence intervals. This regression result is obtained by estimating equation:* $Y_i = \alpha + \beta_1 IPV_i + \beta_2 T_i + \beta_3 IPV_i * T_i + \beta_4 H_i + \beta_5 X_i + \varepsilon_i$, *where* Y_i *is the number of statements participants agreed with;* H_i *represents the seasonal fixed effects;* X_i *is HH and location characteristics;* T_i *is treatment dummy;* IPV_i *is a binary variable that indicates whether the list contains an IPV item or not. Coefficients of household characteristics, month, and village-level fixed effects are not reported for brevity.*

4.3. Underlying mechanisms

Our analysis revealed preliminary evidence supporting sleep quality and thermal comfort as key underlying mechanisms for the impact of cool roof interventions on intimate partner violence (IPV). Cool roof implementation demonstrated a significant improvement in both sleep quality and thermal comfort (*Table 5*), highlighting their crucial roles in mediating the relationship between environmental factors and IPV.

Table 5: Mechanisms

	# times woke up	# hours of sleep	Heat stress score
Treated household	-0.113*	0.039	0.166
	(0.058)	(0.047)	(0.108)
Hot season	-0.010	-0.285**	8.106***
	(0.097)	(0.129)	(0.658)
Hot season*treated	-0.005	0.155**	-2.215***
	(0.062)	(0.063)	(0.540)

House has metal roof	-0.025	-0.036	0.042
	(0.040)	(0.039)	(0.098)
Constant	1.914***	7.951***	1.937***
	(0.108)	(0.196)	(0.491)
Number of observations	2,244	2,242	2,244
R2	0.005	0.011	0.646
Adjusted R2	0.004	0.010	0.646

*Note: 01 - ***; .05 - **; .1 - *. This regression result is obtained by estimating the outcome variable sleep quality and thermal comfort on the dummy for the hot season and the interaction of the hot season with the treatment dummy. Excluded category: village-level fixed effect.*

5. Conclusion

Climate change poses significant challenges, particularly for low-income countries, where rising temperatures are expected to have wide-ranging effects on health, well-being, and social stability (Hsiang et al., 2013). Among these challenges, the impact on interpersonal dynamics, including intimate partner violence (IPV), is of growing concern (WHO, 2018). This study focuses on understanding how a cost-effective passive cooling intervention contributes to the reduction of IPV in climate hot-spot and resource constrained region of the world.

The data used in this analysis was collected as part of a broader project led by the Heidelberg Institute of Global Health (HIGH) in collaboration with Nouna Health Research Centre (CRSN). The project is aimed at studying the impact of sunlight-reflecting roof coatings, known as 'cool roofs,' on the health, environmental, and economic outcomes in Nouna, rural Burkina Faso (Bunker et al. 2024).

This study combines a clustered randomized control trial (cRCT) of with a double list experiment design to evaluate the effectiveness of a cool roof intervention at reducing physical IPV. A total of 600 households were randomly assigned to either a treatment or control group. To address underreporting, IPV data was collected using a double-list randomization experiment. The study also examines psychosocial mechanisms such as sleep quality and thermal comfort, linking temperature reduction to IPV.

Our findings reveal that the cool roof intervention lowered indoor temperature by about 2 °C, which ultimately led to a 7–10 percentage points reduction in IPV. This result highlights the potential of low-cost climate adaptations to improve social outcomes. It underscores the broader implications of climate adaptation strategies in addressing not only environmental challenges but also social issues like IPV. As temperatures rise due to climate change, it is vital to integrating sustainable housing initiatives with IPV prevention efforts to foster safer and healthier intimate relationships in developing country contexts. The findings of this RCT have significant implications for policymakers, practitioners, and organizations working on IPV prevention in developing countries and beyond.

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Appendix

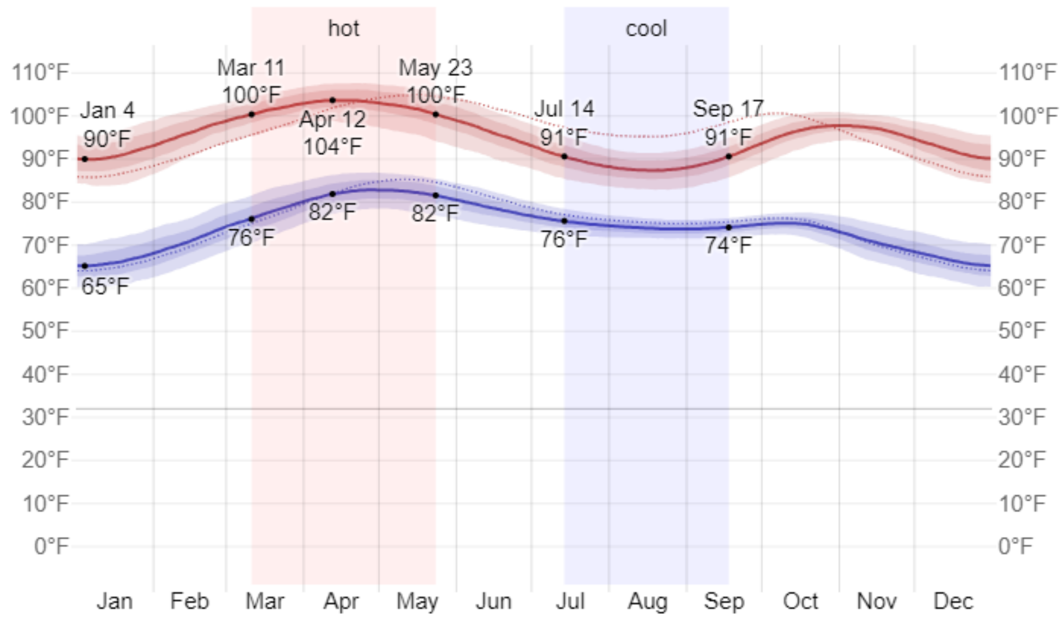

Figure A1: Seasonality in Nouna, Burkina Faso

***Source**: WeatherSpark.com. The daily average high (red line) and low (blue line) temperature, with 25th to 75th and 10th to 90th percentile bands. The thin dotted lines are the corresponding average perceived temperatures (1980-2016)*

Table A1: A double list randomization questionnaire design

Respondents assigned to Group 1	Respondents assigned to Group 2	Prevalence of IPV
List A	**List A**	
1. In the last 3 months, I have taken care of a sick relative who is unable to care for themselves 2. In the last 3 months, I used contraceptives to reduce the incidence of pregnancies 3. *In the last 3 months, I have been slapped, beaten or physically harmed by my husband/partner* 4. In the last 3 months, I ran out of the money I needed for basic things more often than before 5. In the last 3 months, I attended the wedding celebration of a friend/relative	1. In the last 3 months, I have taken care of a sick relative who is unable to care for themselves 2. In the last 3 months, I used contraceptives to reduce the incidence of pregnancies 3. In the last 3 months, I ran out of the money I needed for basic things more often than before 4. In the last 3 months, I attended the wedding celebration of a friend/relative	*In the last 3 months, I have been slapped, beaten or physically harmed by my husband/partner*
# of agreed statements: IPV1-list A	# of agreed statements: IPV0-list A	

List B	List B	Prevalence of IPV
1. In the last 3 months, I spent much more time working than I normally would have 2. In the last 3 months, I thought about having more children 3. In the last 3 months, there were more arguments in our household than there were before. 4. In the last 3 months, I felt much closer to my family than I did before	1. In the last 3 months, I spent much more time working than I normally would have 2. In the last 3 months, I thought about having more children 3. *In the last 3 months, I have been slapped, beaten or physical harmed by my husband/partner* 4. In the last 3 months, there were more arguments in our household than there were before 5. In the last 3 months, I felt much closer to my family than I did before	*In the last 3 months, I have been slapped, beaten or physical harmed by my husband/partner*
# of agreed statements: IPV0-list B	**# of agreed statements: IPV1-list B**	